Ethics and Design in the Brazilian Context

Book Section

I GranDIHC-BR

GRAND RESEARCH CHALLENGES IN HUMAN-COMPUTER INTERACTION IN BRAZIL

Edited by
Brazilian Computer Society | SBC

Organized by
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Cuiabá, Mato Grosso, Brazil

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To Sérgio Roberto P. da Silva *(in memoriam, 2014), our dear friend, for the years of friendship, partnership and work that contributed to the research and teaching of HCI in Brazil.*

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http://comissoes.sbc.org.br/ce-ihc/documentos/RT_GranDIHC_BR_2012.pdf

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Preface

In 2006, researchers from the Brazilian Computing Society *(SBC)* met to discuss and identify the greatest research challenges in computing in Brazil for the following decade. This initiative was motivated by the understanding that computing had become a pillar in scientific research and an indispensable component for the implementation and strengthening of the country's social, economic and technological objectives (SBC, 2006). Thus, the consequences of this area's strategic planning extend out into other areas beyond computing itself.

On the occasion of the SBC's Challenges initiative, five Grand Challenges were proposed and challenge number 4, "Participative and universal access to knowledge for Brazilian citizens" (Baranauskas and Souza, 2006), recognized the role and the importance of the area of Human-Computer Interaction (HCI) for the social, scientific, technological and economic development of the country. Within the 9 central areas of Computer Science, set out in 1988 by the ACM (Association for Computing Machinery), HCI is the area that must deal with issues of a universal nature in parallel with other areas and, at the same time, must consider specific aspects (social, cultural, economic, political and geographical) of the environment in which it is applied.

The Brazilian context is complex. The country has continental dimensions, a population of 200 million people, a diversified culture, and is traditionally marked by social inequality. Although in recent years Brazil has gone through rapid and profound transformation which has led to an evolution of the economic, social and human indexes, its limitations in critical areas to maintain this progress have also become more evident (e.g., in education, science and technology, healthcare, infrastructure, security, etc.). Scientific and technological development is a crucial factor in overcoming these limitations, although their benefits are only achieved and felt in the required dimensions if this occurs in a socially responsible way.

When the coordination team of the IHC 2012 (*XI Brazilian Symposium on Human Factors in Computing Systems*) invited us to organize a panel discussion on the advances of the SBC Grand Challenges, Challenge number 4 in particular, we were encouraged to go a little

further. Primarily because, despite recognizing the advances made on this initiative (e.g., the number of Scientific Events on the topic of the Challenges, specific call for funding, etc.), there remains much to be consolidated by 2016. Secondly, because the opportunity to "listen to" the HCI community was provided in a more systematic and localized way regarding what is considered a challenge for HCI within the Brazil of grand challenges (the ambiguity is intentional).

The GranDIHC-BR was inspired by the Seminar on the Grand Research Challenges facing Computing in Brazil (SBC, 2006) to prospect research questions in the area of HCI that will be important for science and the country in a period of 10 years (2012-2022), extending the reach of SBC Challenge number 4. The initiative was split into 3 stages: (1) inviting and analyzing proposals of Grand Challenges; (2) presentations and discussions with the community on a panel at the HCI national conference (IHC 2012); and (3) group work to propose a set of challenges based on the previous stages. As a result of this collective effort, 5 Grand Challenges for research in HCI for the next decade (2012-2022) were identified.

Although some events had already been organized internationally with the aim of discussing the challenges and the future of HCI, such as the "Being Human" Workshop (Sellen et al., 2009) and, more recently, the "Human-Computer Confluence Research Challenges" (HC@, 2012), as far as we are aware, this was the first initiative for the HCI area in Brazil and Latin America.

The Grand Challenges which resulted from the GranDIHC-BR represent a reflection of the Brazilian HCI community on the area and an opportunity to inspire and guide the direction of HCI research in the country for the coming years. We hope that these Grand Challenges act as a guiding principal for the development of projects that lead to significant scientific advances with social and technological applications. We also hope that this initiative and its results reach out to other disciplines and inspire other developing countries and/or countries with challenges of a similar nature.

This technical report is the organized into 3 parts. In Part I, we present the methodology and the context where the GranDIHC-BR initiative was organized and conducted, including: i) the prospection of the Grand Challenges from the research community; ii) the acceptance and analysis of proposals to form thematic groups and identify candidates to Grand Challenges; and iii) the Panel of the Grand Challenges held in the XI Brazilian Symposium on Human

Factors in Computer Systems (IHC 2012) to socialize the proposals together with the community, and to promote discussions to identify, in a collaborative way, the Grand Research Challenges in HCI in Brazil. In Part II, invited authors present the 5 Grand Challenges — which resulted from the collaborative group work on the results of the activities carried out in Part I, as well as a meta-reflection by the organizers. In Part III, we included as appendices the abstracts of the individual proposals received in the challenge prospection stage, our acknowledgements, references, and authors' details. ❖

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Part I

Prospection of the Grand Research Challenges

GranDIHC-BR:
Context and Organization

The understanding of "Grand Challenges" in diverse areas converges towards a statement along the following lines: A Grand Challenge is a fundamental problem in <<Science, Technology>>, the solution to which has wide <<Applications, Implications>> and enables or leads to great advances in <<Knowledge, Social Development, Economic Growth, etc. >>.

The report on the Grand Research Challenges in Computing (2006-2016) (SBC, 2006) states that Grand Challenges are related to central problems that cannot be solved by short term, individual research studies. They are problems that need to be discussed and approached from different perspectives, with multiple focuses and with results to be achieved over a long period. According to the SBC (2006) proposal, some characteristics of a Grand Research Challenge are:

- A Grand Challenge must be directed towards significant advances in the area and, consequently, in science, instead of being based on incremental results of existing progress.
- The research to advance a challenge must go beyond studies and results that can be developed or achieved in a conventional, individual research project.
- Its progress must be open to gradual achievement and assessment in a way that allows analysis of its evolution and possible changes of direction.
- The success of a Grand Challenge must be measurable in a clear and objective way.
- A Grand Challenge may be multidisciplinary in nature and in its possible solutions.
- A Grand Challenge must be realistic and open to discussion in a feasible period (e.g., 10 years), and at the same time must challenge paradigms, and question and provoke an evolution in the traditional panorama of the area.
- A Grand Challenge emerges from a consensus of the scientific

community to serve a long-term scenario for researchers, regardless of finance policies or cyclical issues.

In the initiative organized by the SBC, five Grand Challenges were identified, whereby Challenge 4 is directly related to the HCI area:

1. Management of information over massive volumes of distributed multimedia data
2. Computational modelling of complex systems: artificial, natural, socio-cultural, and human-nature interactions
3. Impacts on Computer Science of the transition from silicon to new technologies
4. **Participative and universal access to knowledge for the Brazilian citizen**
5. Technological development of quality: dependable, scalable and ubiquitous systems

Grand Challenges can inspire scientific, social and economic development, encouraging the joining of forces of different natures to solve critical problems and deficiencies. After the event promoted by the SBC, other events have been promoted to continue discussing the Grand Challenges and the advances achieved; and calls for research funding in the context of the Grand Challenges have been opened up. The list below shows some of the developments seen in the six years following the SBC's proposal for the Grand Challenges:

2007

- Publishing of the MCT/CNPq/CT-INFO (nº 07/2007) invitation for projects related to the Grand Challenges. A total of 49 projects were selected with a total funding value of 9 million R$; The first call for funding by the FAPESP\Microsoft Research partnership was launched in the State of São Paulo, which selected 5 projects;
- For the first time, the SEMISH (Integrated Seminar of Software and Hardware) focused on the SBC Grand Research Challenges;

2008

- The holding of the ChaRLA'08: Grand Challenges in Computer Science Research in Latin America. In this workshop, the Challenge number 1 "Information and Communication Technology Oriented towards the Citizen" also demonstrates a

clear link with the area of HCI;

- New Call for Funding by FAPESP\Microsoft Research with the selection of 2 research projects;
- SEMISH call for papers in the context of the Grand Challenges;

2009

- SBC organization of the II Seminar on the Grand Challenges for Computing in Brazil;
- FAPESP\Microsoft Research call for funding with the selection of 4 projects;
- SEMISH call for papers in the context of the Grand Challenges;

2010

- Publication of the MCT/CNPq (Nº 09/2010) Call for Projects related to the Grand Challenges; 90 projects were selected with a total value of 10 million R$;
- FAPESP\Microsoft Research call for research projects with the selection of 4 projects;
- SEMISH call for papers in the context of the Grand Challenges;
- Panel discussion on Accessibility at the Brazilian IHC 2010;

2011

- New FAPESP\Microsoft Research call for Projects with the selection of 3 projects;
- SEMISH call for papers in the context of the Grand Challenges;
- Panel discussion at the SBIE 2011 (The Brazilian Symposium on Computers in Education) related to Challenge 4;

2012

- Organization of the DEsafIE! - I Workshop on the Challenges facing Computing Applied to Education at the CSBC 2012 – the Brazilian Computing Society Congress;
- SEMISH call for papers in the context of the Grand Challenges;
- GranDIHC-BR Grand Research Challenges in HCI in Brazil with a Panel discussion at the IHC 2012. ▶

In this context, the GranDIHC-BR was an initiative by the Brazilian research community in HCI to prospect research questions in the area that will be important for science and the country in a period of 10 years (2012-2022), extending the reach of SBC Challenge number 4. This initiative promoted collaborative work and interaction between industry professionals and researchers from the Brazilian community and resulted in the identification of 5 Grand Challenges. The next section shows how the GranDIHC-BR was organized and conducted in its different stages.

Organization

Inspired by the Seminar on the Grand Research Challenges facing Computing in Brazil (SBC, 2006), the GranDIHC-BR sought to discuss the advances made on the SBC Grand Challenges and to "listen to" the HCI community in a more systematic and localized way with regards to what is considered to be a challenge for HCI in Brazil. The GranDIHC-BR was conducted in 3 stages with different activities:

1. Prospection of Grand Challenges; 2. The GranDIHC-BR Panel on IHC 2012; and 3. Consolidation of results. As a result of the collective effort, 5 Grand Research Challenges in HCI for the next decade (2012-2022) were identified.

1st Stage: Prospection of Grand Challenges

- Analysis by the evaluation committee: 14 proposals were received
- Creation of thematic groups: 5 thematic groups were identified
- Group discussion by the authors of the submitted proposals

2nd Stage: The GranDIHC-BR Panel on IHC 2012

- Presentation of the work produced by each thematic group
- Discussion with the organizers, committee and participants

3rd Stage: Consolidation of results

- Analysis of all the produced material
- Presentation of a Grand Challenge related to each thematic group
- Production of a technical report (originally in Portuguese) presenting the results. ▶

1. Prospection of the Grand Challenges

During the prospection of Grand Research Challenges in HCI in Brazil, the call for proposals was sent out to the whole nationwide community. Researchers and industry professionals were invited to fill out an online form[1], in a questionnaire format, presenting their proposals for challenges. Fourteen proposals were received.

The proposals were analyzed by a Committee composed by researchers and industry professionals who made comments on the proposals, grouping them into thematic groups. Each proposal was analyzed by at least 5 reviewers who assigned a grade (A = the highest grade; D = the lowest grade), gave their opinion, and related the proposals to each other using a scale from 0 to 4 (0 = no relation, 4 = strong related).

Based on the analysis by the organizing and assessment committees, a relation matrix was constructed which led to the identification of 5 clusters, called "Thematic Groups". The five Thematic Groups and the proposals in each group are listed below:

G1. The Future, Smart Cities and Sustainability

- Human Interaction with Smart Cities
- Interacting in a more Sustainable Manner.

G2. Accessibility and Digital Inclusion

- Touchscreen Interfaces Accessible to People with Visual Disabilities
- Portability on Inclusive Social Web
- Information Dissemination and Sharing in Traditional Oral Communities.

G3. Ubiquity, Multiple Devices and Tangibility

- Assessment of the Quality of Human-Computer Interaction in Ubiquitous Systems
- Simultaneous Use of Multiple Devices in Routine Daily Activities
- Universal Access to Information and Knowledge via Brain-Computer Interface
- Tangible Interface of Physical Artefact of Accessible Interaction.

G4. Human Values

- Privacy in the Connected World
- Posthumous Interaction and Post Mortem Digital Legacy. ▶

[1] http://goo.gl/4yo5Y (Last access: 21/07/2015)

- Ethics and Design in the Brazilian Context.

G5. HCI Education and the Market

- Increasing Brazilian Competitiveness in the Digital Technology Market.
- HCI Education

After the definition of the Thematic Groups, the authors of the individual proposals performed a joint task in order to: i) identify the challenge behind each thematic Group; ii) state it in the form of a "challenge", i.e., the appropriate level of impact and magnitude; and iii) point out anticipated immediate applications and implications. As support material, the authors received all the challenge proposals in the same thematic group and the feedback provided by the assessment committee.

2. The GranDIHC-BR Panel at the IHC 2012 Conference

The result of the collaborative work performed by the authors of the proposals in each thematic group was presented at the GranDIHC-BR Panel held on November 6th 2012, in Cuiabá, during the XI Brazilian Symposium on Human Factors in Computer Systems (IHC 2012).

With a duration of 4 hours, the Panel discussion explained the context of the SBC Grand Challenges, their results and other initiatives. There was also a presentation of the activities being carried out to identify the HCI Grand Research Challenges for the next 10 years (2012-2022). After this introduction, each group presented its proposal for a Grand Challenge, which was discussed with participants of the assessment committee and the whole community present at the event. Representatives of all the Thematic Groups as well as researchers/professionals from all regions of the country were present at the panel discussion. Adding to the face-to-face discussions, an online form was made available so that all the participants could make contributions during the event.

3. Consolidation of the results

In this last stage, the authors, who presented the work carried out in the Thematic Groups of the HCI 2012 Panel discussion, were invited to ellaborate a text presenting the Grand Challenge in each group, demonstrating:

1. The importance and benefits of seeking a solution for the Challenge;
2. Ways of identifying/measuring the success of the research advances;
3. Possible difficulties and barriers to successful research; and
4. Action that must be taken in order to face the challenge in a period of 10 years.

The 5 HCI Grand Research Challenges that emerged from this joint effort by the Brazilian HCI community are presented in the next section of this report (Part II). Figure 1 shows a TagCloud created from the texts elaborated for the Challenges. ❖

Figure 1. *TagCloud* generated from the 50 most common terms found in the text of the Grand Challenges presented in the Part II of this eBook. Stop words were removed from the visualization, i.e., terms related to the activity title and/or its immediate context (e.g., Challenges, HCI, Interaction).

Part II

Grand Research Challenges in HCI in Brazil 2012-2022

Challenge 1

The Future, Smart Cities and Sustainability

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Sustainability is the term given to the practice of consuming and ensuring future supply. More than an environmental aspect related to solutions that do not harm the environment, such as the reduction of fossil fuel consumption and the development of more efficient energy solutions, the issue of sustainability also involves social and economic aspects. The social aspects are related to human rights, respecting differences, and the dissemination of values that are the basis of the continuance of life in society for future generations. The economic issues put the focus on the development of solutions that are financially viable, generate profit and support income distribution.

Computers have a central role in the theme of sustainability. On the one hand, they are more and more present in people's lives and favor the spreading of information on a large scale and can be a useful tool for raising awareness, mobilization and promoting changes in behavior that encourage sustainability. On the other hand, computers are consumable goods and, therefore, impact on issues of sustainability requiring the rethinking of our design, development and disposal practices. The role of the designer in the development of a sustainable society is not only to create sustainable products, it is also to envisage products, processes and services that encourage responsible consumption and sustainable behavior.

The challenge of interacting in a more sustainable way is related to the search for user interface solutions that raise awareness and provide instruments for Brazilian citizens, enabling better relationships between individuals themselves and with their surroundings, including the environment, the cities and the technological solutions, in an intelligent and more sustainable way. These systems, as well as considering economic sustainability, should reflect social and technological values and encourage new ways of thinking, living and doing business. In this sense, the challenge consists of the search for tools, methods, models and theories that lead to more sustainable behavior. Research along this

line takes into account emotional, motivational and organizational factors, behavior on social networks, aspects of health and well-being, intellectual development as well as justice, peace and equality. In a more explicit way, it is expected the creation of sustainable communities; the development of ubiquitous solutions and smart environments; the stimulation of respect for others, the rational transport with optimized logistics and the production of smart vehicles, healthy food and the effective management of supplies, the development of effective solutions for e-waste, etc.

On the other hand, this challenge also considers the insertion of sustainability principles in the design, conception and development of technological solutions. In this sense, the challenge consists of rethinking Human-Computer Interaction techniques and models in the light of the premises of sustainable design. Research in this line, considers, among other things, the conception of methodologies that are agile; takes into account the user's social, economic and environmental context; the natural integration and the creation of a symbiosis in the software development processes; allows the reuse and recycling of artefacts, models, software and hardware; and expresses concerns with quality, waste, with flexible and more perennial solutions.

Interacting in a more sustainable way constitutes a challenge, initially, due to the need to raise awareness of designers and users to the fact that thinking, developing and using sustainable solutions is not a passing fad but rather it is a genuine attempt to establish a bridge between the real world and an ideal world. Consequently, it is necessary to rethink the way we develop and consume technological solutions, considering the situated design solution and its impact in the social, economic and environmental ambits.

With respect to the issues of sustainability, the Brazilian scenario presents some disparities. On one hand, the country has traditionally discussed the issue of environmental impact and has hosted international events on this topic. However, the initiatives to raise ecological awareness and preserve natural resources, with the support of technology, remain timid. From the social point of view, the enormous differences found in Brazil make more sustainable interactions an even greater challenge. In relation to the economic issues, purchasing power in Brazil has increased leading to new users acquiring information and communication technology solutions. This unchecked consumption, regardless of sustainable interaction, may aggravate the differences in which we live. ▶

Faced with this adverse scenario, we must not turn away from discussing and discovering new ways of interacting, with the support of innovative designs, to promote conscientious consumption and more sustainable practices, be this in the relationship between individuals and the environment or in our own work and technology development relationships. It is also necessary to rethink and discover how to make information available on public platforms making them more accessible and integrated in order to bring a number of improvements in the quality of life as well as assessing the impact of these new design solutions in the social, economic and environmental ambits.

Solutions for this challenge go through the search for, and subsequent adaptation and development of new artefacts, tools, techniques, methods, theories and models that offer sustainable behavior and consider the economic, social and environmental aspects in an integrated way from the very start of a design process. The solutions must be flexible, in order to deal with the complex and diverse scenarios, and take into account the peculiarities of individuals, devices and the environment where the interaction occurs. Collective awareness, cultural values and emotional and motivational aspects must be taken into consideration.

Design solutions that support sustainable behavior by means of interaction between individuals and communities and information and communication technology must take into account the participation of different stakeholders. There also needs to be investment in renewal, reuse and disposal of software and hardware as part of the design requirements.

Advances in research related to this challenge must lead to behavioral changes in society. In this sense, new ways of assessing interaction, with other principles, directives and standards that consider, for example, the promotion of peace, health and well-being, must be proposed. ❖

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Challenge 2

Accessibility and Digital Inclusion

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We are seeing more and more convergent scenarios of innovative technology use. As HCI professionals, we perceive an ecosystem of development and use of interactive application that needs to be understood. Firstly, we must understand that we are dealing with an ecosystem formed mainly of people with different needs and difficulties who need to access these applications and be able to use them. The Convention on the Rights of Persons with Disabilities (UM/2007) and the Law 5.269 of December 2004, establishes that accessibility must be offered to all or to the greatest possible number of users in restrictive situations. However, many people who do not have disabilities live in a culture of information sharing through the tradition of orality. Secondly, this ecosystem must not be isolated from what already exists, be it a web or mobile app, or even in the oral community networks organized around other media (such as radio and TV). The scenario is greatly diversified with several perspectives to study such as economics, social, technological and others.

This Grand Challenge has implications for the quality of use of these ecosystems. Specifically, where it is possible to use technology, we follow this line of thinking: "for the people without disabilities, technology makes things easy. For the people with disabilities, the technology makes things possible" (Radabaugh, 2007). Inspired by this, we think it is critically important to design accessible, flexible and adjustable interfaces that consider the variable contexts and cultural diversity in Brazil. This solution will give people with disabilities a way of participating in society using computer devices to perform study, leisure, communication and even work activities in a more autonomous way. Furthermore, strategies for the development of people's skills based on orality need to be implemented to the point where they themselves find solutions for their own problems especially those related to human relationships, (domestic violence, basic sanitation, family farming, citizenship etc.)

Thus, we state that it is necessary to construct systems that can be generalized over multiple devices and at the same time be

specialized for different users with different needs. The difficulties are: acquisition and technology development costs, as well as difficulties in integrating the ways of making knowledge available. Having diverse areas of knowledge, from different contexts, devices, and users means it is necessary to use ontological structures that are sufficiently expressive in order to represent such differences and to make inferences (mechanical or otherwise) from them.

The availability of mobile devices is a tendency. In the case of touchscreen devices, the visual aspect of applications prevails making interaction more complex for the visually impaired, especially for interactions that occur by means of localization and capture of elements, movements and gestures on the screen. Thus, it is necessary to investigate the area of cognition of spatial orientation concepts by means of maps/mental models, as well as having a conception and utilization of standards that facilitate the development of accessible interfaces.

Finally, there are difficulties in the participatory development and integrated use of this ecosystem. HCI techniques (such as design thinking and end-user programming) can enable these people to collaborate but the difficulties are similar to those of innovative design. The users, stuck in current interaction paradigms, are not able to predict new uses for tools and processes, or even new forms of interaction. Besides this, the solutions for the interaction project do not reach people who are outside the current paradigm of the Human-Computer Interaction. These are people who do not have the basis for current structured interactions and require low cost solutions. The cognitive, affective and material barriers to interaction between people and digital technology must be reduced through solutions developed in areas such as HCI, effectively collaborating in order that these solutions work on whole human development.

Widely publishing the results obtained from the approaches and technologies proposed for the development of such ecosystem is also a way of identifying the advances in research located in the context of this Challenge. This requires presenting the aspects collected and the actions taken for its success. Some examples are given below, though this is not an exhaustive list.

Aspects to collect:

- People from oral communities (mainly from rural areas) who learned to use (and even promote) technology for their own benefit together with applied HCI techniques;

- Solutions related to cognitive theories that investigate the correlation of meaningful learning for people with disabilities with its implication for interaction projects;
- Techniques of usability, recommendations and directives that were adapted and/or created in order to guide the development of the proposals and accessible applications that are adaptable to both users and locations; and
- Ontological structures created to represent diversity, and infer from it, as well as providing an integrated system.

b) Action to measure the level of success achieved:

- Measure the quantity of publications and hardware patents and/or registrations of the software developed;
- Measure the intellectual capital developed by the participants as a result of direct action in the areas of this Challenge;
- Analyze the acceptance and mobile device usage rates;
- Verify beneficiary user satisfaction in terms of technology use for social and digital inclusion; and
- Analyze aspects of human behavior (such as self-esteem, quality of life, valuing work) when people are divided into those that have learned to use technology for their own benefit and those that have not.

c) Action to be taken in the coming years are:

- The creation of a Research Center aimed at developing and innovating on the topic of Assistive, Adaptive and Inclusive Technology;
- The insertions of courses with a multidisciplinary focus in ecosystem construction in the Computing courses syllabuses.
- Raising awareness within the industry of the commercial potential for this market niche;
- Promoting the continuity and improvement of initiated research and development proposals by means of events, competitions and promotions. ❖

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Challenge 3

Ubiquity, Multiple Devices and Tangibility

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There are a growing number of ways to interact with the digital world being made available in people's daily lives and this brings a variety of interaction opportunities. The opportunities are discovered by users who, being avid seekers of innovative experiences, try out emerging technologies. These technologies may include, but are not restricted to, Ubiquitous Systems (US), Simultaneous Multi-device Interaction (SMDI), Tangible User Interfaces (TUI), Gesture-based Interfaces (GBI) and Brain Computer Interface (BCI). It should be noted, however, that Brazilians are still large consumers of traditional or offline media (such as radio and TV) but have been experiencing simultaneous use with online media such as watching TV and social networks [1].

There are challenges that have implications for the quality of use of each of these technologies. The challenges to be investigated and their respective solutions in the next 10 years are relevant to the HCI community since from these technologies come new interaction paradigms as envisioned by Weiser [2] who a decade ago stated that computer services should be accessed at any time and in a transparent way.

When there are integrated, multi-disciplinary and inclusive solutions, some of the benefits that can be achieved are: **i)** providing users with computer services with the ability of capturing their experiences, intentions and reactions as well as performing these services with the least possible intervention, and therefore having the ability to adapt. And, **ii)** increasing the opportunities for the user to be a "multi-tasking", participative, productive and healthy person with the appearance of different applications such as ubiquitous parking, intelligent classrooms, life assistance, social networks, entertainment systems, sports and health, and transport and logistic systems. ▶

Different research questions are involved in this Grand Challenge, such as:

- Which theoretical models should there be to help define the interaction context, from individual aspects (a person's cognitive ability, health, motivation and values) aiming for natural interaction, which is often concurrent and fun? For example, supporting real time adaptation has been presented as a solution when dealing with cultural diversity, accessibility, etc. However, taking into account the non-deterministic nature of the user and the interaction environment has still not been presented in the conditions discussed in this Challenge;
- How to assist decision-taking in interaction models through theoretical models and mathematical formulations that can provide explanations, predictions and optimizations of/for interactions phenomena between users and systems? We are tempted to limit our decisions to the characteristics of emerging technologies to take advantage of their utilities and their fun nature, transforming technology into an end in itself and not a means;
- How can we better exploit the visual stimuli in BCI solutions when the design of this kind of systems has not been developed by HCI specialists? and;
- How to define new methods and techniques to help the design and evaluation of the interaction of US, SMDI, TUI, GBI and BCI where inputs are the diverse variables presented, considering the diversity of the Brazilian context?

Research in the context of this challenge is necessary and important for the Brazilian scenario. One way to identify the success of the progress of research is to "measure" Brazilian consumption of services with technology related to the challenges presented in this proposal. Other ways may appear from the following aspects such as, but not limited to, these:

- Physical artefacts of more accessible interaction that have been developed and used towards the benefits set out in this text;
- More hybrid brain-computer interfaces, that is, those that are not limited exclusively to exploring concentration/meditation and/or users' response to visual stimuli. ▶

- Tangible interfaces that are more contextualized within the diverse realities of interaction and immersion in users' daily digital technology;
- Models, methodologies, theories and/or tools that have been evolved or created to specifically support the project and/or the assessment of non-invasive BCIs, US, SMDI, TUI and GBI;
- Interaction paradigms and standards, metaphors and recommendations for the quality of user experience with these technologies; and
- Academic publications, patents and registration of software developed by the HCI community.

Considering the actions that must be taken to face this challenge in the next 10 years, we highlight the development of new devices for the integration and/or substitution of existing ones. Importance must be given to the immersion and engagement aspects of these interactions since there is a tendency towards intensive use of these devices. There should be studies on the relationship between the user performing tasks virtually and still maintaining their values, such as still remaining available for effective social integration.

Another action is the development of tools for the construction of environments with diverse characteristics (such as convergence, distribution and migration) and which have implications for the design of user experiences with the technology mentioned. Migratory environments must support the continuity of experiences, for example. Furthermore, there is a need for research to identify new tangible and gesture-based interfaces. Currently, the industry is already able to develop and sell devices that meet such needs. New actions need to cover ethical and behavioral aspects involved in the use of such devices. For example, the insertion of intra-body hardware (bio chips) will allow for interaction and integration with a variety of computational interactions. Only with exhaustive research in the areas covered by this challenge will it be possible, 10 years from now, to positively assess such initiatives.

Finally, any action taken needs to integrate the concepts involved in this challenge in a wide-ranging and practical way whilst not forgetting the ethical and behavioral aspects. The integration of diverse research groups and the application of advanced concepts is a path that will lead to the identification and validation of the models that will guide users in their (new) daily lives. Such initiatives must be encouraged not only by academia but also by the industry. ❖

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Challenge 4

Human Values

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The presence of technology is growing in all aspects of life, often meeting the needs of a practical and/or immediate nature. This evermore expressive presence places into question the need for greater understanding of the theoretical horizons in order to provide direction for technological development.

In Brazil, socio-economic development catalyzes the penetration of technology into a large variety of spheres as it increasingly provides access for a greater number of people to technological goods. The yearning for new technology and the rapid production of innovation might result in ignoring or giving less value to human aspects, which involve a number of values in technology development and use, during system conception and design. Furthermore, users might not be completely aware of the objectives and possible individual or social risks and impacts of technology use

Since the Web is becoming ever more social, such issues must be considered by technology researchers and developers. Thus, as central issues on the challenge of Human Values, the aspects of ethics, privacy and digital legacy stand out.

- **Ethics:** What is the relationship between ethics and design? How can designers be made more aware of the ethical impacts of the purpose of their solutions? And how can this same awareness be promoted in users of design products and other stakeholders? How can consideration of ethical aspects in system assessment be promoted?
- **Privacy:** What information is collected and what can be directly or indirectly exposed about users? How can a user be enabled to anticipate the combination of parameters in terms of what information is visible about him and to whom? How can we ensure harmonic levels of sociability and privacy? ▶

- **Post-Mortem Digital Legacy:** How can users determine their wishes in terms of their digital legacy, taking into account legal restrictions? What is the impact of "posthumous interaction" and how should it be dealt with? What is the best way to align design with current legislation or even contribute to the formulation of issues that deserve to be standardized by regulations?

Ethics, in this proposal, is considered to be a reference point for system design and evaluation allowing for better understanding of the "problem space". Privacy, one of the values of "digital living", as well as the destiny of users' digital legacies, raises issues of possession and ownership, straining the values of different stakeholders. With the aim of assessing progress on the proposed challenge, periodical surveying is suggested of:

- The quantity of articles published in journals, conference and books that cite human values or ethical aspects, or that propose methods aligned with the challenge;
- Research projects approved by university Ethics Committees to survey their explicit ethical concerns;
- The number of calls for projects that are concerned with or require inclusion of human values or ethical aspect;
- The number of class hours in courses of Computer Science, Information Systems and other courses related to design and HCI that explicitly mention human values or ethical aspects; and
- Design products (hardware, software, websites, etc.) that explicitly cite these aspects.

In the context of this Grand Challenge, we can point out some of the possible difficulties and obstacles to obtaining research success:

- There is a difficulty in aligning research and the creation of legal norms due to the lack of communication between academia and the legislative power. Those who make the laws are not necessarily involved in or have knowledge of research in the area;
- There are no specific calls for projects in the area of HCI which makes it even more unlikely to have calls for a particular issue such as ethics. Without funding resources, development of the area is compromised.
- Measuring/assessing research success in the area is not so simple since, due to the nature of the problem, metrics that are

merely "objective" and quantitative may not be sufficient. On the other hand, qualitative/reflexive metrics are difficult to assess externally.

In the chart that follows, we identify a series of actions that can aid activities in favor of the expansion of this challenge as well as possible obstacles in the execution of these actions. Such obstacles allow for the definition of overall strategies for mitigating risks when working in with Human Values. ❖

Actions/Decisions	Possible obstacles to execution
Provide continuity of working on the challenges in the Brazilian community of HCI so that the scientific community as a whole can gain knowledge about this and encourage research and study in this area.	Initiatives at the HCI national conference or publications forums to disseminate the challenges and discussion of related research.
Setting up workshops on the topic for national and international events.	Possible submission of few articles in the first workshops on this topic.
Creation of competitions, prizes or contests for solutions that promote and consider ethical aspects in technology design and use.	At a time when there are many contests, prizes and competitions it may be difficult to attract participants, especially whilst there is still little awareness of the importance of this subject. However, discussion can be encouraged by inserting the topic in, for example, the HCI Evaluation/Design Competition.
Setting up research and support programs that encourage: • Models that value users' freedom of choice • The training of the user in terms of assessing the aims and possible consequences of use of the technology.	Divergent political interests and excessive bureaucracy can impede setting up funds especially if they are specifically for HCI. There is a need to sensitize agents that can support initiatives within strategic organs.
Incentives for the creation of teaching material on this topic to be included in the HCI curriculums.	"Slowness" in altering curriculums and in adopting alterations by higher education institutions.
The organization of national and international publications on topics involving Human Values.	There are few authors in this area even though the topic of privacy is more wide-ranging.
Incentives for interdisciplinary and inter-institutional work to encourage scientific and technological production on this topic.	The lack of value given to and overall difficulty of promoting interdisciplinary and inter-institutional work. Brazil has lower rates compared with other countries.

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Challenge 5

HCI Education and the Market

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To think about and to "do" higher education in Brazil are constant challenges. Specifically in the area of Computer Science, this challenge translates into the qualification of professionals to develop interactive computer systems of a high quality.

The quality of the interaction and the user interface is recognized by academia and by the industry as a determining factor for the acceptance and effective use of systems by users and there are even specific norms for this, such as ISO 13407 (User Centered Project) and ISO 9241-210 (User eXperience). In the national context, the Brazilian Computing Society (SBC) recognizes the importance of the discipline of Human-Computer Interaction (HCI), which has been part of the recommended curriculum for undergraduate students in the area of Computing since 1999, on courses of Computer Science and later on other courses linked to it.

Despite having this recommendation, the subjects offered in the area of HCI are still considered optional in most Computing curriculums, which also affects the creation of research groups and the formation of a critical mass which helps the growth of research in this area in some parts of the country.

Analyzing the requirements that are set for hiring professionals of this area and the elements of the subjects offered on Computing courses, it can be seen that the graduated professionals have the potential the market requires. However, these positions still have an emphasis on training in Design. Graduates in Computing courses that have studied HCI have skills and competencies incorporated into their work practices that go beyond those required for the development of technologies and systems, especially with regards to

the concern for the different profiles of users of these technologies. So, adding this subject to all courses in this area will culminate in the formation of professionals that the market requires.

We see as a challenge the promotion of collaboration between educators, institutions and the labor market for: making HCI a compulsory subject; standardizing the content and teaching practices between Computing departments, understanding the complementarity provided by other areas such as Design, Psychology, Communication; and understanding – and meeting, when appropriate - market requirements, which would ensure greater alignment with and facilitation of insertion into the labor market, given the competencies acquired by the learners.

A series of workshops on HCI education (WEIHC), started in 2010, has been regularly organized by the Brazilian Symposium on Human Factors in Computer Systems (the national HCI conference promoted by SBC). WEIHC has presented, as results, action proposals for HCI in the classroom (pedagogical practices) and promotion of the area, among other recommendations, but this still represents an isolated effort since it mostly brings together members of the scientific community who are already interested in the practice and teaching of HCI.

It is important that the discussions at events such as the WEIHC also reach the professionals who are already within the industry and who are part of the communities that are formed around organizations such as the IxDA, BR-CHI and UXPA, for example. Also, this discussion can be widened into other forums besides IHC/SBC. Currently, the *Interaction South America* (ISA) event has been growing in terms of participation, covering a different community than that of the IHC/SBC. At IHC/SBC, the participants come mostly from the academic community who bring and discuss quality scientific work in the area, whereas in ISA, participation is more diversified covering different professionals in the area. Despite the difference in focus and audience, both conferences deal with similar topics and problems, which could favor and offer input to the discussion on the teaching of HCI and subsequent formation of professionals in the area.

Within this context, there are things that need to be done in a harmonic way by educators, researchers and professionals, such as:

- Review the HCI curriculum recommended by the SBC;

- Compile HCI teaching material and teaching practices to support teachers in this area;
- Highlight the importance of HCI to students and teachers on courses in the area of computing as well as to computing professionals who will receive most of the graduates in their companies;
- Establish conversations with the labor market, with other sub-areas of computing and also in other areas, highlighting the inter and multidisciplinary nature of the area and seeking cooperative projects.
- Promote HCI as a basis to support entrepreneurship and innovation by bringing together the professional and academic communities related to these topics.

Some indicators can be established before and after these actions such as:

- The number of undergraduate courses offered.
- The number of Course conclusion studies in HCI directed to market requirements.
- The number of Scientific Initiation Projects in HCI registered in High Education Institutions.
- The number of students finishing computing courses who work in the area of HCI.
- The number of students that start post-doctorate programs who research HCI.
- The strengthening and formation of Research Groups in this field.
- The number of places available for internships and jobs in HCI with emphasis on Computing.
- The average salaries of the positions and professions that are directly related to HCI.
- The appearance of new job and position titles directly related to HCI.
- The presence of HCI professionals in corporate leadership positions (e.g., Product Manager, CEO, etc.).
- The number of companies set up by HCI professionals (consultancies, startups, etc.). ▶

- The presence of terms in the media related to HCI (both specialized and non-specialized) particularly for the public at large. E.g., in 2004, the main character of a soap opera on Globo TV was a webdesigner.

It should be noted that some of these actions are already in progress. In 2013, the WEIHC had its main focus on the reviewing of Computer course syllabuses (focusing on Computing, Information Systems, Computer Engineering and Software Engineering). Also, a survey was carried out with lecturers and professors in the field of HCI to discuss the current teaching scenario for this subject in Brazil. ❖

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Meta-Reflection: Challenges for HCI in the Brazil of the Grand Challenges

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HCI is focused on the design, evaluation and construction of interactive systems for human use and the study of the main phenomena that surround them[1]. Within the core of Computer Science set out by the ACM, HCI is the field that needs to deal with issues of a universal and intertwined nature in relation to other fields and, at the same time, must consider specific aspects of the environment (social, cultural, economic, political and geographical) in which its application takes place.

Asked about the future of the HCI field, from different viewpoints, authors such as Bannon (2011), Bødker (2006) and Sellen et al. (2009) find that the relationship between people and technology has changed intensely in recent years. These changes are profound to the extent that they led to a review of the field of HCI, its theories, methods and practices. According to these authors, even the terms "interaction", "human" and "computer" should be revisited, requiring deeper understanding of what it means to be human, what and where is the computer/technology and what is interaction like in a society mediated by information and communication technology.

Considering interactive digital systems as vehicles with which to access the knowledge in the modern world, and the complex and challenging context of Brazil — a country of opportunity but which is also marked by inequalities and chronic deficiencies (e.g., infrastructure, education, healthcare) — the field of HCI has an important role and the responsibility to direct efforts towards producing studies and results that help to overcome the challenges of this access.

The GranDIHC-BR, held in Cuiabá at the IHC 2012 Conference, resulted in the identification of five Grand Research Challenges in HCI in Brazil for the next 10 years (2012-2022). These Grand Challenges emerged from the joint efforts of the community and demonstrated the field's comprehensiveness and the diversity of

[1] http://old.sigchi.org/cdg/cdg2.html#2_1 (last access: 31 July 2015).

issues that need to be taken into consideration. The Grand Challenges that were identified, as described in previous sections, were:

1. The Future, Intelligent Cities and Sustainability
2. Accessibility and Digital Inclusion
3. Ubiquity, Multiple Devices and Tangibility
4. Human Values
5. HCI Education and the Market

The five Grand Challenges are wide-reaching and represent fundamental problems in terms of Science, technology and public policies, the solutions to which may have profound reach and impact on Brazilian society and may be able to produce great progress in terms of knowledge and socio-economic development. To make progress in the context of these challenges requires multidisciplinary approaches (theories, methods, tools) and application in practical contexts with the possibility of making real contributions.

The five Grand Challenges point to problems of different natures and represent a scenario to aim for in terms of research efforts, partnerships, development and creation of public policies and incentives on a national basis. Challenge 1 highlights smart cities as an important context and raises the issue of sustainability in a wide-ranging and systemic form, recommending that issues related to software and hardware renewal, reuse and disposal must be included as design requirements. Challenges 2 and 3 naturally extend the reach of SBC's Challenge #4, "Participative and Universal Access to Knowledge for Brazilian Citizens" (Baranauskas and Souza, 2006). Challenge 2 shows the need for the construction of systems that can be generalized for multiple devices and, at the same time, be specialized for different users with different needs, and suggests the use of ontological structures that are sufficiently expressive to represent such differences and act on them. Challenge 3 highlights the development of new devices in such a way as to consider immersive and engagement aspects of the interactions. Although human values are subjacent to all the 5 Challenges proposed, Challenge 4 specifies and goes deeper into the issue of human values and their intrinsic cultural nature, highlighting aspects of ethics, privacy and digital legacy in interactive systems. Challenge 5 makes the concern with HCI education explicit and predicts the potential relationship and impacts of education for computing professionals in the software industry and in the market.

Each Grand Challenge requires investigations and advances in

different perspectives that are equally challenging. From a **technical** perspective, new technologies need to be developed - or reinvented, or existing technologies combined and adapted - so as to solve problems and deficiencies that are typical in Brazilian society. From a **theoretical and methodological** perspective, we need to re-think the way we understand and how we do designing, revisiting our theories, practices, artefacts, the methods used, and developing new theories and methods situated in the current and foreseeable scenarios. From a **social** perspective, we need to widen the view regarding the nature of the problems we deal with, and regarding the impact of designed solutions on the behavior and the lives of people. It is desirable for these above-mentioned perspectives to be consistent with the commitment to facilitate access to knowledge when designing ways of interacting with technology.

The Grand Challenges that the HCI Brazilian community have proposed do not exhaust the possibilities of research innovation in this area, but rather suggest, in a socially relevant way, directions for the Brazilian community to work on in the forthcoming years. Therefore, it is important to keep up with the work developed in the context of the Grand Challenges, to constant evaluate the achieved progress, and to redefine directions when necessary.

The GranDIHC-BR initiative needs to be spread into other initiatives - as happened with the SBC's Grand Challenges in 2006 - and be taken into consideration in work developed by the community, gaining space in new discussion forums, promoting and widening discussions on the topics. The IHC 2014, held in Foz do Iguaçu, gave space to work on the Grand Research Challenges of HCI in Brazil, inviting researchers and practitioners to submit their Position Papers (see the References section). The IHC 2015 to be held in Salvador, in turn, included the Grand Research Challenges in HCI as one of its topics of interest.

Finally, it is our responsibility, as industry professionals and academics, professors and tutors, event organizers and paper reviewers, to create an open environment for the discussion and development of innovative work, which is open to novelty, able to define its own direction and meet the present and future demands of Brazilian society. ❖

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Part III

Appendices

The Proposals for Grand Challenges

This section presents a summary of the 14 proposals submitted and analyzed during prospection for the Grand Challenges in the community — the first stage of the GranDIHC-BR. These proposals were fundamental for the identification of the Thematic Groups and for the promotion of the discussion between the proponents with the aim of identifying the challenges related to each group. Figure 2 shows a TagCloud created from the summary of the 14 proposals submitted. Following this, each proposal is presented in order of submission. ❖

Figure 2. *TagCloud* created from the 50 most frequent terms in the summary of the 14 proposals. "Stop words" were removed from the visualization, i.e. terms related to the activity title and/or its immediate context.

01. Human Interaction with Smart Cities

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The 20th Century has been marked mainly by the rural exodus around the world. Due to urbanization and the economic development of large urban centers, billions of people were attracted to better opportunities. In 2008, half of the planet's population lived in cities and it is estimated that this number will increase by 70% by 2050. In Brazil, this is already a reality. In 1975, more than 60% of the population was living in metropoles and 25 years later this number has increased to 81%. Economic greatness and opportunity have their price. According to specialists, healthcare, security, urban mobility and natural problems are among the main problems facing large cities. Within this scope, dealing with a large amount of information in order to overcome these obstacles is a daily challenge. Smart cities came about in order to provide agility by improving urban system management and better use of resources. Thus, a variety of initiatives have emerged in recent years around the world. However, interacting with smart cities is no easy task. There are various forms of interaction to offer, visualize and integrate a variety of data in real time. Within this context, investigating new interaction methods, standards, technique and models can directly contribute to solving the problems of large cities. ❖

02. Evaluating the Quality of Human-Computer Interaction in Ubiquitous Systems

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With the advance of computer resources, users can access information, carry out daily tasks and communicate rapidly from anywhere and with any kind of interactional device. Such ubiquitous systems should provide the most natural kind of interaction possible, which brings important issues related to the field of HCI. For example: Is additional value being added for the end user? Are users satisfied when using this type of system? Do they really meet the users' expectations? These questions become challenging for a number of reasons. The first is the difficulty in making these systems available in the real world and still be able to collect and store data on continuous interaction. The second is the complexity in dealing with tasks that might be suspended and restarted as well as being shared with a number of participants. The third is that the diversity of devices, user position (e.g. walking, sitting, running) and interaction modes (e.g. touch screen, gestures, voice, eyes) makes it complex to implement systems that can adapt to these different contexts in a transparent way. However, we believe that these questions can be answered by means of evaluating of the quality of user interaction with ubiquitous systems. ❖

03. Touchscreen Interfaces Accessible to People with Visual Disabilities

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Technological convergence and the demand for sharing information made solutions with portable devices such as tablets and smartphones very popular and these have become ever more present in human daily activities (e.g. work, study, entertainment) making the availability of content for these a tendency. Following the huge success of the iPhone, touchscreens and multifunctional devices without a physical keyboard are becoming standard characteristics of these devices. In the case of touchscreen devices, the visual aspect of applications prevails making interaction more complex for the visually impaired, especially for interactions that occur by means of localization and capture of elements, movements and gestures on the screen. The challenge proposed is, therefore, to break down the barriers of interaction for visually impaired users for touchscreen devices that are imposed on them by the disability, design, novelty, developer ignorance and the evolution of technology itself. To achieve this, it will be necessary to develop new applications, recommendations and the discovery of new interaction paradigms, especially with multimodal interfaces. Research on the interaction of the visually impaired with such devices will be a growing demand and the results of this will have a strong social and inclusion impact. ❖

04. Privacy in the Connected World

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Currently, people use a variety of systems to collect, process and transmit information about themselves such as e-commerce systems, content sharing and social networks. A number of these systems allow users to exchange information among themselves or even to recommend content or people to other users. In addition, the systems themselves transmit information about the user's interaction with the system or with other systems. Thus, creating more personalized and productive interactions whilst at the same time maintaining users' security and privacy is a challenge. Even when users understand what they should or should not share with other users (or systems), anticipating what the combination of parameters means in terms of what information is visible about them and to whom, can be an obstacle. The question of privacy is an international challenge since this change in the use of technologies and the integration between them is happening around the world. It also has a strong national component in that privacy is a cultural value within society. Thus, understanding aspects of privacy specific to the Brazilian context is relevant since aspects valued by our culture can differ from those in other cultures. ❖

05. Interacting in a more Sustainable Way

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Sustainability is the term given to the practice of consuming and ensuring future supply. More than an aspect of environmentalism, the question of sustainability involves social and economic aspects. Computers have a central role in the question of sustainability and are more and more present in people's lives and favor the spreading of information on a large scale and can be a useful tool for raising awareness, mobilization and promoting changes in behavior that encourage sustainability. On the other hand, computer solutions are consumable goods and, therefore, impact on issues of sustainability requiring the rethinking of our design, development and disposal practices. From this perspective, we need to find user interface solutions that raise awareness and provide instruments for Brazilian citizens enabling better relationships between individuals themselves and with their surroundings, including the environment, the cities and the technological solutions, in an intelligent and more sustainable way. The challenge, therefore, consists of the search for tools, methods, models and theories that encourage conscientious consumption, more sustainable behaviors, the development of sustainable communities and intelligent environments that consider aspects of health and well-being, intellectual development, justice, peace and equity. ❖

06. Portability in the Inclusive Social Web

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The Web can be seen as an ecosystem of interconnected resources made up of rules, strategies, organizational structures and mainly people. The Web movement seeks the convergence of technologies from desktops to different mobile devices, enabling the widening of access to information. As a consequence of this movement and because of the ease of access to ICTs, the Web has become the natural pathway to universal access by means of the A5 (Anybody, Anywhere, Anytime, Any device Access) thus facing the challenges of participatory and universal access to knowledge. Although the Web provides a path to reaching more people, these technologies are still not able to meet public needs even when connected. On one hand, some existing tools take into consideration system design according to the characteristics of the devices, but do not consider the diversity of users (i.e. skills, preferences, culture, physical and educational limitations, among others). On the other hand, some systems are aimed at people with specific needs but do not consider other needs or availability for multiple devices. Thus, I state that it is necessary to construct systems that can be generalized over multiple devices and at the same time be specialized for different users with different needs. ❖

07. The Challenge for HCI: Increasing Brazilian Competitiveness in the Digital Technology Market

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Despite being known as a country of creative people, Brazil is constantly quoted negatively when the topic is international competitiveness, especially in the field of digital technology innovation. HCI is already seen as a subject that can contribute strongly to technological innovation and, consequently, help to change the scenario mentioned. Two points, however, attract attention: 1) There is a lacuna of knowledge on how to create products with good user experience, and 2) The difficulty in having access to prototyping technologies and producing digital products is a barrier for students and inventors. In relation to point 1, there are already efforts being made to popularize and spread knowledge of HCI and associated areas using cases of success. As for point 2, there are also some good examples, such as the communities of free software, free hardware and free design. Such movements, however, occur in parallel. A way forwards towards improving Brazil's competitiveness in digital technology may therefore lie in the integration of these initiatives: on one hand, knowledge of HCI; and on the other, cheaper alternatives for prototyping and production. This way, HCI, as a discipline, would be able to promote the appearance of innovative solutions for daily problems that arise from a mass of creative people. ❖

08. Information Dissemination and Sharing in Traditional Oral Communities

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The sharing of information has an important role in human evolution. With the advent of information technology, distances shrank and the evolution of human knowledge multiplied. However, these technologies are not accessible to the great majority of the non-urban and needy populations, part of which remains connected mainly thorough the tradition of orality. For example, the subsistence farmer, the seamstress who learnt her trade from her mother and grandparents, and people in the old *quilombola* (escaped slave community) that struggles to maintain its legacy. The current approaches to digital inclusion are incomplete since they do not solve problems or contribute to holistic human development. This way, we understand that the next Grand Challenge for HCI as a subject is, by means of an essentially anthropocentric and contextualized approach, to lead the reduction of cognitive, affective and material barriers that exist in the interaction between people and digital technology. The anthropocentric focus shows us we must look towards man, and his own paradigms, and HCI should first seek the common elements of human beings, their ways of communicating and interacting, their real needs and thus promote ways of accessing information and transforming it into knowledge. Communities based on orality are found in all points of under-development in the world and there lies its national and international relevance. ❖

09. Education in HCI

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One of the Grand Challenges in the area of Computer Science is the education of students and professionals for the development of interactive computer systems of high quality. The quality of the interaction and the user interface is recognized by academia and by the industry as a determining factor for the acceptance and effective use of systems by users. However, teaching practices in computing treat aspects associated with HCI as marginal. Indeed, teaching HCI is still considered an optional subject in most computing curricula and even when it does occur, the content and pedagogical practices vary considerably between one institution and another. It is also a fact that the subject of HCI is strongly influenced by new technologies (such as ubiquitous interaction, touch and multi-touch), working methods (such as user-centered design, user activity analysis, participatory design, etc.) as well as by the context of use of solutions which require particular interface properties (e.g. usability, accessibility, communicability, user trust, user experience, among others). Therefore, the teaching of HCI can be seen as a Grand Challenge that aims to definitively integrate human factors into the development of interactive systems. ❖

10. Digital Legacy and Interaction: Port-mortem aspects

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The post-mortem information legacy raises many issues. Some proposals have been discussed in the academic and corporate environments, but the topic is still relatively new. In this sense, it is necessary to distinguish not only the precepts of information legacy in digital spaces, but also the consequences of the presence of this information on the Social Web such as, for example, manifestations of digital mourning and the data overloading of servers. As designers and stakeholders, attentive to Human-Computer Interaction aspects, it is important to understand how such issues affect system development. Professionals of information and communication technology are so involved in the digital culture that they end up not remembering to model some aspects that have a large impact on society, especially if we consider the use of software on a large scale. However, they must try to visualize what is behind the visible aspect of the interface and should model solutions taking into account social aspects however difficult it may be due to a mismatch between actions and artefacts in the real and virtual worlds. We know that ethical, moral and legal aspects are among the many concerns for designers and have been the topic of discussion by the HCI community. And this is how it should be, given the possibility an individual's data existing on the web ad infinitum and the posthumous interaction represented by this. Because of the profoundness of this challenge and given the need to model it for interaction beyond the lifetime of the internet account's user/owner, this should be treated in an interdisciplinary way, taking into account areas of Law, Language, Psychology, Sociology, History, Anthropology, Archeology and Biblioteconomy, for example, so that the systemic and computational issues can be discussed. ❖

Reference:
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11. Ethics and Design in the Brazilian Context

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Often driven by practical and immediate requirements, more and more people are incorporating technology into a variety of aspects of their lives, often without reflecting on the consequences of using them. On the other hand, studies on interactive system development that lead to behavioral change have been gaining ground on the agenda of large HCI conferences. This movement brings to the forefront the fundamental issues of ethics in design and technology use. A designer's intentions, when directing certain actions or behaviors, are not always explicit or desired by the stakeholders affected by the use of the technology. Systems that induce an undesired purchase, or even those that use conditioning strategies to cause a behavioral change are examples of such intentions. The challenge proposed is therefore about the relationship between design and personal freedom in a way that these technology users do not become victims, either passively or submissively, of the effects of its use. This advance allows for the redefinition of the relationship between man and technology, and the application of new forms of designing and developing interactive systems that take into account the ethical aspects of this relationship. ❖

12. Simultaneous Use of Multiple Devices in Routine Daily Activities

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Going beyond an easy or "invisible" interaction, the user may come across simultaneous use on different devices in order to perform possibly different tasks. The identification of a context sensitive computing would not be limited, for example, to the presence of a person in the space or to body movement and facial movements but to the other equipment within the environment. We emphasize that the impact of interconnection in real time (and intensively) of multiple devices and multiple objects must be analyzed from the perspective of cognitive, emotional and psychological aspects in the long and short term. In this scenario, there are some challenges: a lack of understanding of an individual's capacity to interact in the conditions mentioned and of the implications of this for his health, happiness and productivity; (ii) the inexistence of methods and characteristics that must/can be applied to the interfaces to help the user prioritize the information while in simultaneous use; (iii) we further add that as devices become cheaper, there will be a cultural, social and economic diversity of users that will make it harder to define values (human, social and cultural) and may affect the definition of interaction patterns, information recommendation strategies, etc. ❖

13. Universal Access to Information and Knowledge via Brain-Computer Interface

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This Challenge proposal involves a type of user interface that is still poorly explored by the Brazilian HCI community or even by the HCI communities around the world: the non-invasive Brain-Computer Interface (BCI). Based on the principle that we have the "domination" of technologies related to BCIs — e.g. brain signal capture and its extraction, selection and classification — the focus of the Challenge proposed here is to maximize access to information and to knowledge via interfaces between the user and computer using brain waves, i.e. in an effectively universal way. This type of user interface does in fact have the potential of being universal for anyone regardless of their physical and maybe even cognitive condition. This interface seems to allow access to information and knowledge in a more effective way than is available in digital format in the modern world, e.g. the Internet (the cloud). This proposal constitutes a challenge because compared with some more usual interfaces, e.g. desktops and web, BCIs have still been very poorly explored from the HCI viewpoint. Deepening the studies of Interaction Design of BCIs seems to be opportune and promising. ❖

14. Tangible Interface of Physical Artefact of Accessible Interaction

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This challenge proposal brings another type of user interface that has been little studied/explored by the Brazilian HCI community: the Tangible User Interface (TUI). This type of interface can be applied in a variety of contexts and with different interaction intentions, e.g. in education and entertainment. "Concrete" interaction with digital information from tangible interfaces brings the possibility of constructing more dynamic and recreational interfaces. Thus, deepening the study of Interaction Design of this type of interface can contribute to the specification and development of new physical interaction artefacts, which are indeed more accessible. Due to the "conceptual" characteristics that define the TUIs, it seems that the accessibility aspect of this type of interface is by itself a Grand Challenge for the area of HCI. In the Brazilian context, few studies have been made in relation to TUIs from a HCI viewpoint, despite the international literature in this area presenting some published studies on this type of interface, such as in INTERACT, ACM CHI and HCII. ❖

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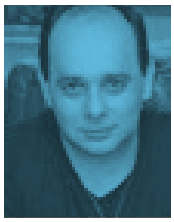

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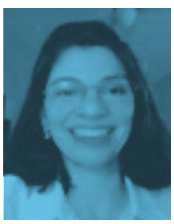

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